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Skomer Marine Conservation Zone Sponge Diversity Survey 2015

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& P. Newman

NRW Evidence Report No.159



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Synopsis

Sponges are an important feature of Skomer Marine Conservation Zone. A four yearly full species monitoring programme has been in place since 2003, but records exist from 1991. The number of species/entities recorded to date is 130, of which around 33 are undescribed or need further investigation.

In 2015 six sites were surveyed on the south side of Skomer Island as part of the continuing full species monitoring programme. A total of 67 species/entities were recorded in situ or from samples taken for microscopic identification of spicules. Of these, 11 are undescribed or need to be fully researched.

Subsamples of 53 sponges were sent to Dr. Joanne Preston, Institute of Marine Science, University of Portsmouth, for molecular research.

Crynodeb

Mae sbyngau'n nodwedd bwysig o Barth Cadwraeth Morol Sgomer. Cafodd rhaglen bedeirblynyddol ar gyfer monitro rhywogaethau ei rhoi ar waith yn 2003, ond ceir cofnodion o 1991 ymlaen. Nifer y rhywogaethau/endidau a gofnodwyd hyd yn hyn yw 130, ac o blith y rhain mae oddeutu 33 heb eu disgrifio neu mae angen ymchwilio ymhellach iddynt.

Yn 2015 arolygwyd chwe safle ar ochr ddeheuol Ynys Sgomer fel rhan o'r rhaglen fonitro. Cofnodwyd cyfanswm o 67 rhywogaeth/endid ar y safle neu yn y samplau a gymerwyd ar gyfer adnabod sbigylau trwy ddefnyddio microsgop. O blith y rhain, mae 11 heb eu disgrifio neu mae angen ymchwilio ymhellach iddynt.

Anfonwyd is-samplau o 53 o sbyngau i Dr. Joanne Preston o'r *Institute of Marine Science*, Prifysgol Portsmouth, ar gyfer ymchwil folecwlwr.

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1. Introduction

Although there are around 15,000 sponge species currently known to exist worldwide, sponge biodiversity is still relatively poorly known. In recent years a significant number of diving surveys have taken place around the UK specifically targeting sponges (Picton & Goodwin, 2007; Goodwin & Picton, 2011), and these have resulted in several new species being described and an increase in the occurrence of previously rarely recorded species. Sponge monitoring programmes have also been in place within the Skomer Marine Conservation Zone/Nature Reserve in Pembrokeshire since 1993, shortly after it was designated a Reserve in 1990.

Skomer MCZ is considered to be one of the richest areas in the UK for marine sponges. The number of species/entities recorded has been steadily increasing over the last 30 years and currently stands at around 130. A number of undescribed species are known to be present, as well as recently described or rarely recorded species.

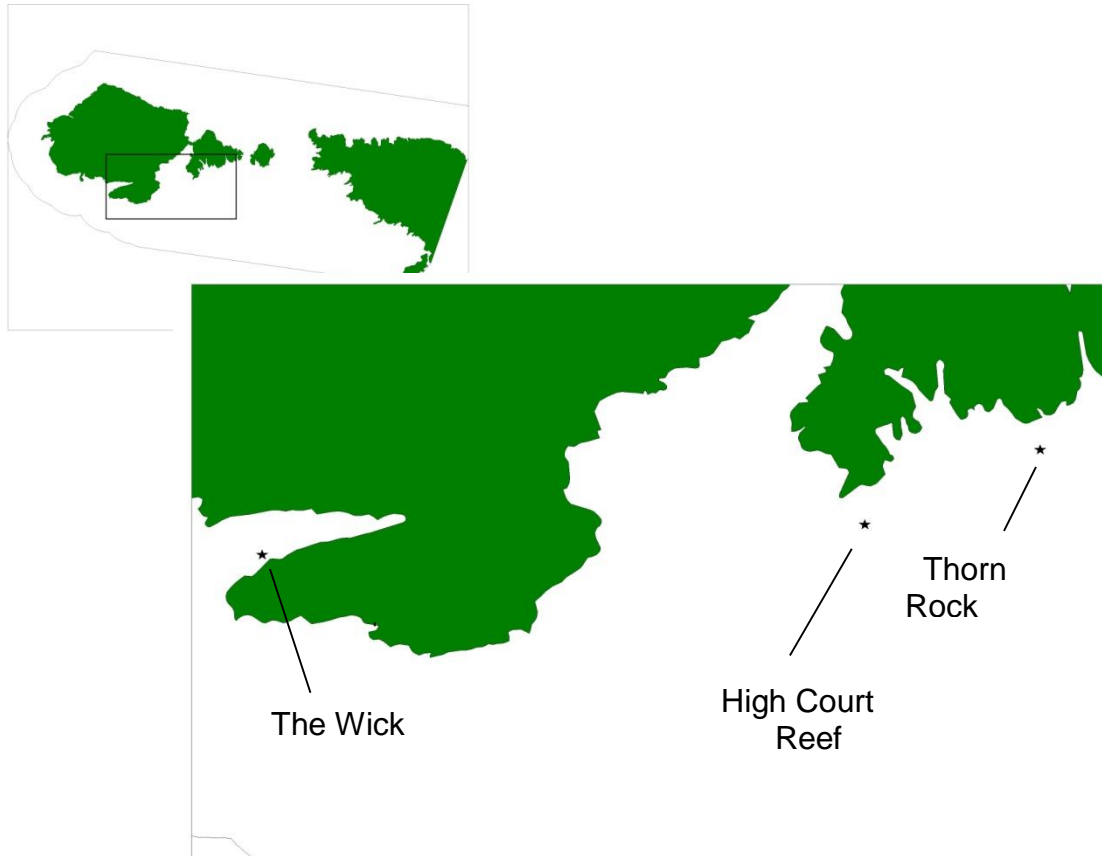
Sponge population monitoring was first set up in 1993 at the Thorn Rock site on the south side of Skomer Island to investigate the temporal changes within sponge communities. The communities have been recorded since then using a mixture of photography and video. Given the difficulty of identifying sponges either from photographs or in the field it was decided to complement this monitoring with a full species identification survey, although it was not deemed necessary for this to be on an annual basis. The current methodology involves taking photographs of the site annually to count the abundance of sponge species and morphology types, and doing a full species survey every 4 years, the first of which was in 2003. In 2011 and 2015 samples were collected and identified from two additional sites, High Court Reef and The Wick.

In 2015, in addition to the four yearly species survey, the SMCZ collaborated with Portsmouth University to collect samples for DNA analysis from as many sponge species as possible. At the moment there is very little DNA information for UK species, and it is hoped that this work will make a major contribution to the DNA database and act as a very important resource for future biodiversity surveys.

The barcoding of the Skomer MCZ sponges was carried out in conjunction with the Sponge Barcoding Project that aims to obtain DNA signature sequences from more than 8,000 described sponge species and estimated 15,000 unknown. As sponges are notoriously difficult to identify, sponge barcodes are an essential tool for identification and understanding their importance for ecosystem functioning.

2. Survey Sites

Fig. 1 Map of Skomer MCZ showing locations



Most sponge species are tolerant of some silt, but as filter feeders they benefit from being in an area with some water movement. However, locations that are very tide swept are not suitable habitats for many sponges and therefore not very rich in terms of diversity. The north side of Skomer Island has noticeably less variety than the south side, with very few encrusting species but large growths of massive sponges eg *Cliona celata* that are known to thrive in more exposed situations. For this reason surveys have been concentrated around the south side of the island, however in 2015 some samples were collected from Rye Rocks, North Haven during a routine dive.

2.1 Thorn Rock

Four separate sites have been surveyed in this area as part of the full species survey, chosen for their varying habitats. There is a notable degree of silt at this location, making it particularly suitable for silt-tolerant sponges such as encrusting *Eurypon* spp and branching *Raspailia* and *Stelligera* spp.

2.1.1 Windy Gully

Windy Gully is a narrow gully approx 2 metres wide with vertical walls two metres high at a depth of 15 to 17m below chart datum (bcd). The walls are dominated by erect and encrusting sponges, including the nationally scarce species *Axinella damicornis* and *Tethyspira spinosa*, and rich hydroid and bryozoan turf.

2.1.2 Spongy Hillocks

Spongy Hillocks is an area of horizontal seabed with rock outcrops at a depth of 17m bcd covered with erect and cushion sponges including *Stelligera stuposa* and *Polymastia* spp., with many hydroids present.

2.1.3 Dog Leg

Dog Leg is an area of uneven bedrock at a depth of 15m bcd with erect and cushion sponges including *Polymastia* spp on the horizontal surfaces and encrusting sponges on the shaded and overhanging areas, with abundant hydroid and bryozoan turf.

2.1.4 Broad Gully

Broad Gully is similar to Windy Gully, approx 4 metres wide, with high vertical walls dominated by a large variety of encrusting sponges, including a number of undescribed *Eurypon* species, at a depth of 17m bcd.

2.2 The Wick

The south side of the Wick is a vertical rock face 50m high continuing underwater to 8m bcd with an undercut forming an overhang down to 12 to 15m bcd, where large areas of the encrusting sponge *Thymosia guernei* are present. The rock is covered with diverse fauna, dominated by sponges and jewel anemones (*Corynactis viridis*), with frequent occurrences of the nationally scarce sponges *Phorbas dives* and *Stelletta grubbii*.

2.3 High Court Reef

This rugged site at 17m bcd consists of a series of rock pinnacles with vertical walls up to 5m high and deep gullies of between 2 to 5m width with large boulders, some being extensively covered with the encrusting sponge *Phorbas fictitius*. Gully walls are particularly rich with abundant faunal turf including sponges and cup corals (*Caryophyllia smithii*).

3. Methodology

For the full species survey, each site listed was visited on at least one occasion. All sponges that could be easily identified in-situ were recorded. If a sponge could not be identified or the identification needed confirmation, a sample was taken for examination of its internal skeleton. A photograph was taken of the sponge, after which a sample was collected and placed in a numbered bag. All samples were then split into three sub-samples where possible and placed in tubes of absolute alcohol for preservation. One sub-sample was kept for the SMCZ collection, a small piece of which was used to obtain a spicule preparation for microscopic examination to confirm the identity of the sponge. A second sub-sample was kept for the Museum of Wales, and the third sub-sample was sent to the University of Plymouth for DNA analysis. This was not possible with every sponge as it was sometimes difficult to get a large enough piece for all of the above purposes. In this instance the sample was kept for the SMCZ collection and to obtain a spicule preparation.

In addition to the above, as part of the Barcoding Project a list was drawn up of species that could be reliably identified in the field. For each species a photograph was taken in situ and a sample of the sponge was collected, preserved in absolute alcohol and sent to the university. A tissue sample of approximately 0.5 cm³ was subsampled for DNA extraction from every species sample. Each of these tissue samples was rinsed with 750 µl of 1 M Tris-HCl to remove any Ethanol from the tissue that may interfere with the DNA extraction.

The DNA from 53 species were extracted using XYZ kit following the manufacturer's guidelines. To verify the successful DNA extraction, DNA quantity and purity were estimated by measuring the sample absorbance's at 230, 260 and 280nm using an ND-1000 spectrometer (Nanodrop®, USA). The success of the PCR will be checked by gel-electrophoresis and samples with a positive outcome, purified and sent for sequencing.

4. Results

This survey resulted in a total of 67 species/entities being recorded from 125 samples over 15 dives. Two species, *Prosuberites longispinus* and *Spongosorites calcicola*, have not been recorded in previous surveys while nine are undescribed/new to science. Two species notable by their absence were *Paratimea constellata* and *Hymenaphia stellifera*. These have consistently been found in previous surveys, however both are very small thin crusts and can be easily overlooked so it is likely they are still present.

The most frequently recorded species were *Cliona celata*, *Dysidea fragilis*, *Hemimycale columella*, *Pachymatisma johnstonia*, and *Stelligera stuposa*.

The Wick proved to be the richest individual site in terms of species found, although Thorn Rock as a whole location had a greater diversity. A full list of species found at each site is in Table 1 below.

The DNA work is ongoing, and a report of the findings and results will be sent to the SMCZ for information upon its completion.

Species	The Wick	Windy Gulley	Broad Gulley	Spongy Hillocks	Dog Leg	High Court Reef	Rye Rocks
<i>Amphilectus fucorum</i>	X	X	X		X		
<i>Antho inconstans</i>	X	X			X		
<i>Antho involvens</i>	X						
<i>Aplysilla rosea</i>	X						
<i>Aplysilla sulfurea</i>	X		X				
<i>Axinella damicornis</i>	X	X	X	X	X		
<i>Axinella dissimillis</i>		X	X	X	X	X	
<i>Axinella infundibuliformis</i>		X	X		X	X	
<i>Chelonaplysilla noevus</i>	X		X				
<i>Ciocalypta penicullus</i>				X	X		
<i>Clathrina coriacea</i>	X						
<i>Cliona celata</i>	X	X	X	X	X	X	X
<i>Dercitus bucklandi</i>	X	X	X				
<i>Desmacella cf annexa</i>	X	X			X		
<i>Dysidea fragilis</i>	X	X	X	X	X	X	X
<i>Eurypon major</i>		X	X		X	X	
<i>Eurypon sp 'B'</i>	X		X		X	X	
<i>Eurypon sp 'C'</i>			X				
<i>Eurypon sp 'D'</i>	X						
<i>Eurypon sp 'E'</i>			X				
<i>Halichondria panicea</i>	X						
<i>Haliclona fistulosa</i>						X	
<i>Haliclona oculata</i>		X	X	X			
<i>Haliclona urceolus</i>		X		X	X	X	
<i>Haliclona viscosa</i>	X		X			X	
<i>Halicnemia patera</i>	X		X	X	X		

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<i>Hemimycale columella</i>	X	X	X	X	X	X	X
<i>Hexadella topsenti</i>		X	X	X	X	X	
<i>Homaxinella subdola</i>		X	X	X	X	X	
<i>Hymedesmia jecusculum</i>						X	
<i>Hymedesmia pansa</i>	X						
<i>Hymedesmia paupertas</i>	X						
<i>Hymeniacidon perlevis</i>	X						X
<i>Iophon hyndmani</i>						X	
<i>Microciona armata</i>					X		
<i>Microciona cf armata</i>					X	X	
<i>Microciona sp 'A'</i>		X					
<i>Mycale rotalis</i>			X		X	X	
<i>Myxilla incrustans</i>	X						
<i>Myxilla rosacea</i>	X						
<i>Pachymatisma johnstonia</i>	X	X	X	X	X	X	
<i>Phorbas dives</i>	X						
<i>Phorbas fictitius</i>			X	X		X	X
<i>Phorbas plumosum</i>	X						
<i>Phorbas punctata</i>					X		
<i>Phorbas sp</i>		X	X			X	
<i>Phorbas sp 'A'</i>	X			X			
<i>Plocamionida ambigua</i>		X	X	X		X	
<i>Polymastia boletiformis</i>		X	X	X	X	X	
<i>Polymastia penicillus</i>			X	X	X		
<i>Prosuberites longispinus</i>	X						
<i>Protosuberites incrustans</i>	X	X	X	X	X		
<i>Pseudosuberites sulphureus</i>	X	X		X		X	X
<i>Raspaciona aculeata</i>	X	X					
<i>Raspailia hispida</i>		X	X	X	X	X	X

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<i>Raspailia ramosa</i>		X	X	X	X	X	X
<i>Sphaerotylus sp 'A'</i>			X	X	X		
<i>Sphaerotylus sp 'B'</i>		X					
<i>Spongosorites calcicola</i>	X						
<i>Stelletta grubii</i>	X						
<i>Stelligera rigida</i>	X			X	X	X	X
<i>Stelligera stuposa</i>		X	X	X	X	X	X
<i>Suberites carnosus</i>			X	X	X	X	
<i>Sycon ciliatum</i>	X		X	X	X		
<i>Tethya citrina</i>	X	X	X	X	X		
<i>Tethyspira spinosa</i>		X	X	X	X	X	
<i>Thyrosia guernei</i>	X		X	X			X
Total	37	29	36	29	34	28	11

Table 1

5. Notable Species

5.1 *Spongosorites Calcicola* Picton & Goodwin, 2007

This species was described from Rathlin Island, Northern Ireland in 2007 (Picton & Goodwin, 2007 a,b), although it had been seen previously at scattered locations in Southern Ireland. It has since been recorded from one site in Scotland. This is the first record of the species for Wales, and the first time it has been found on rock other than limestone. It was found in the Wick forming extensive large patches on the wall.

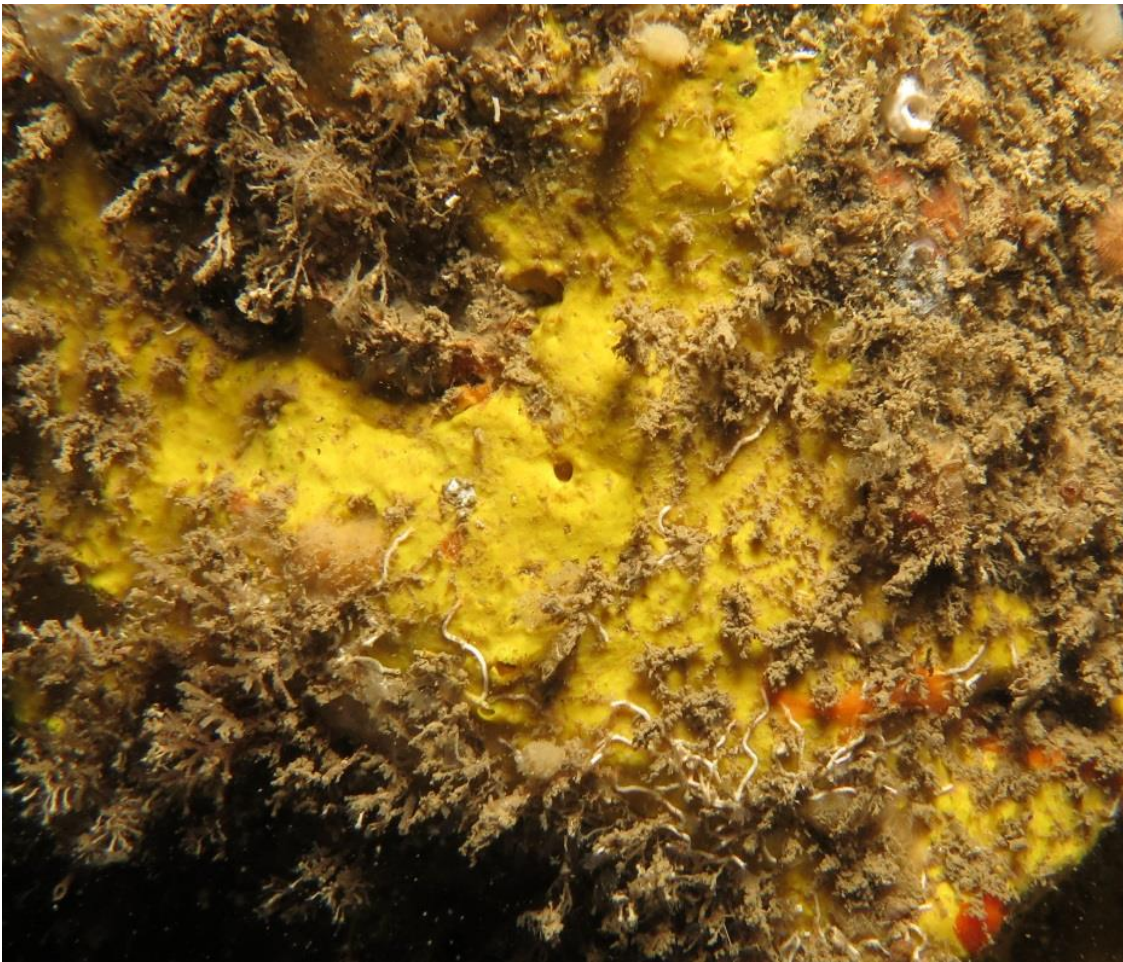


Fig. 5.1 *Spongosorites calcicola*

5.2 *Prosuberites Longispinus* Topsent, 1893

This is primarily a Mediterranean species and was found in the Reserve for the first time in 2009 during the Sponge Diversity of the UK project (Goodwin & Picton 2011). This was the first record for the UK mainland. It was found again during this survey at The Wick.

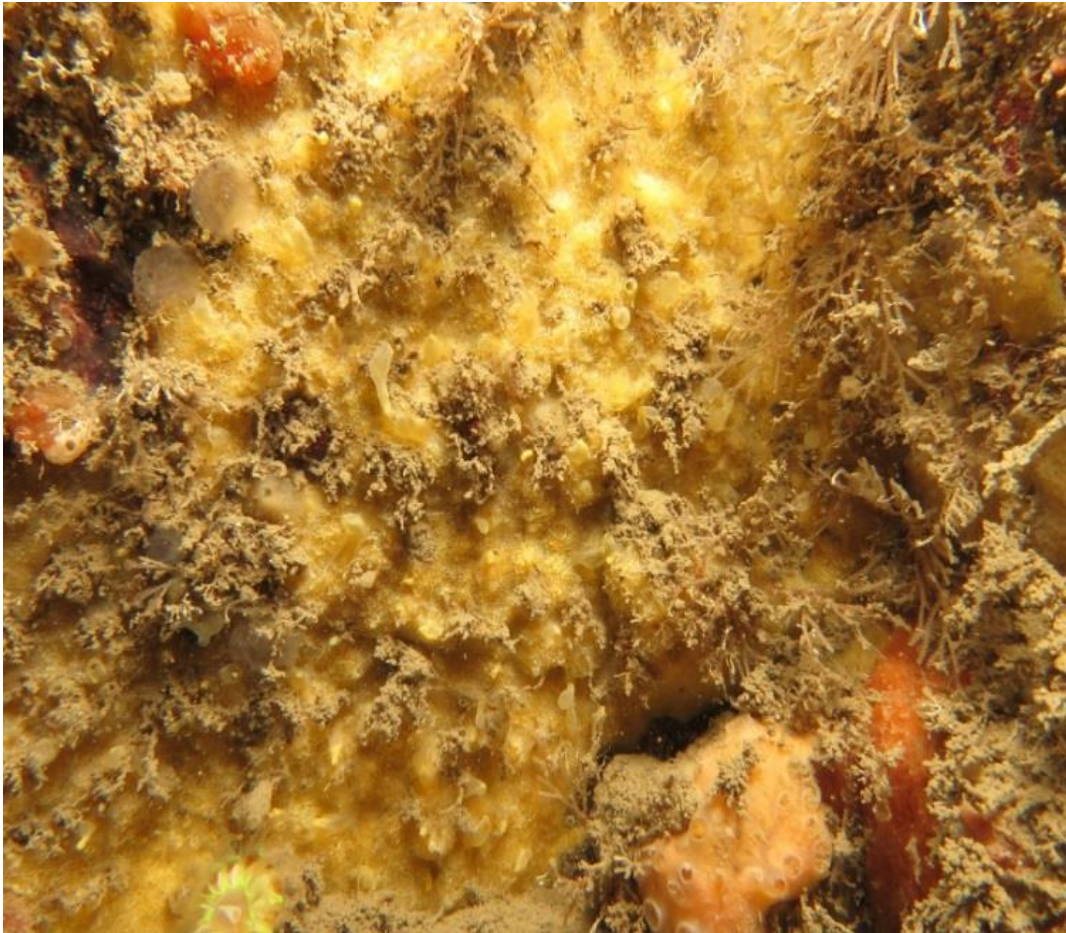


Fig 5.2 *Prosuberites longispinus*

5.3 *Clathria (Microciona) sp 'A'*

A single specimen of this sponge was found at Windy Gully, Thorn Rock. Microscopic examination of the skeleton showed a distinct difference between this and all known described *Microciona* species.

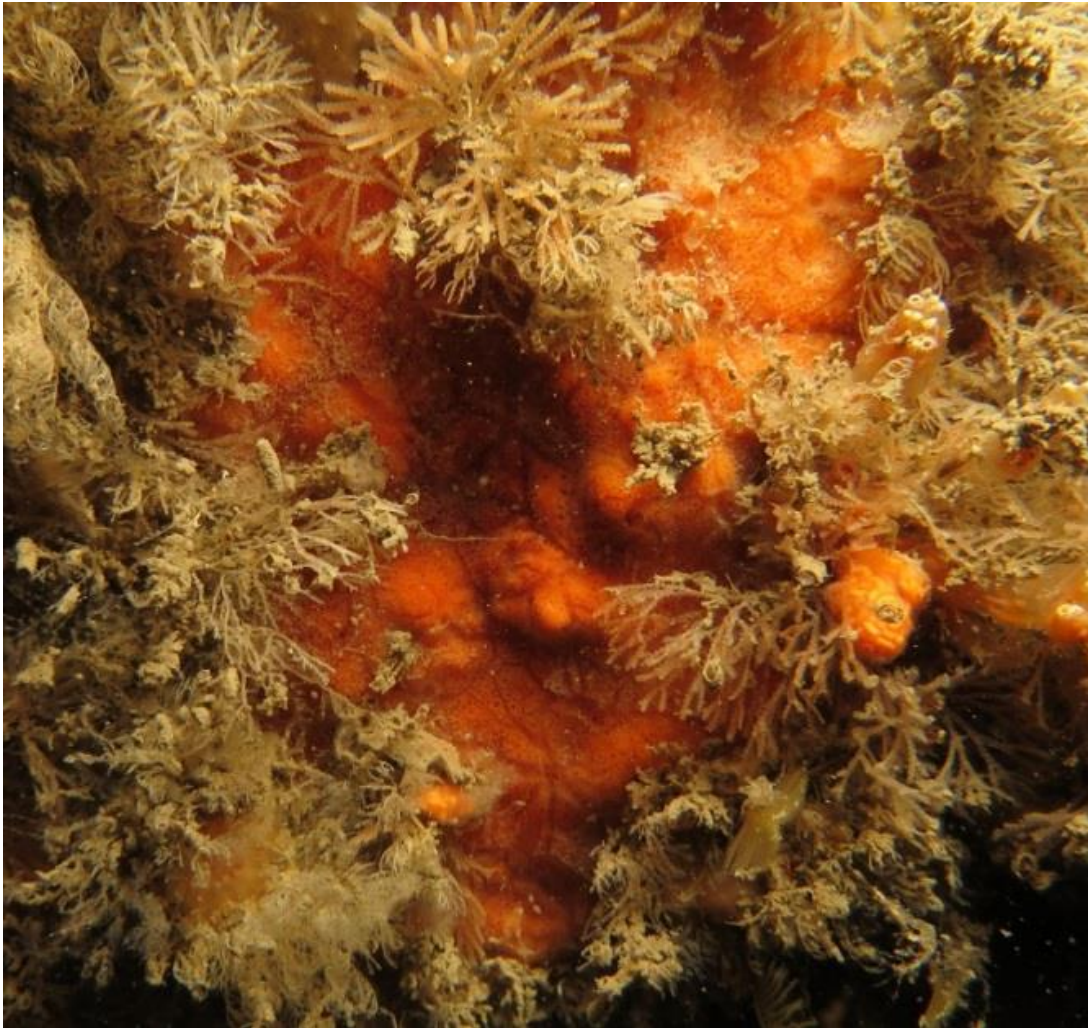


Fig 5.3 *Clathria (Microciona) sp A*

5.4 *Phorbas* Sp

This species was identified from samples collected at Windy Gully, Broad Gully and High Court Reef. Microscopic examination showed that the spicule complement differs from other *Phorbas* species. It was found once before during the 2011 sponge survey (Jones & Bunker, 2011).

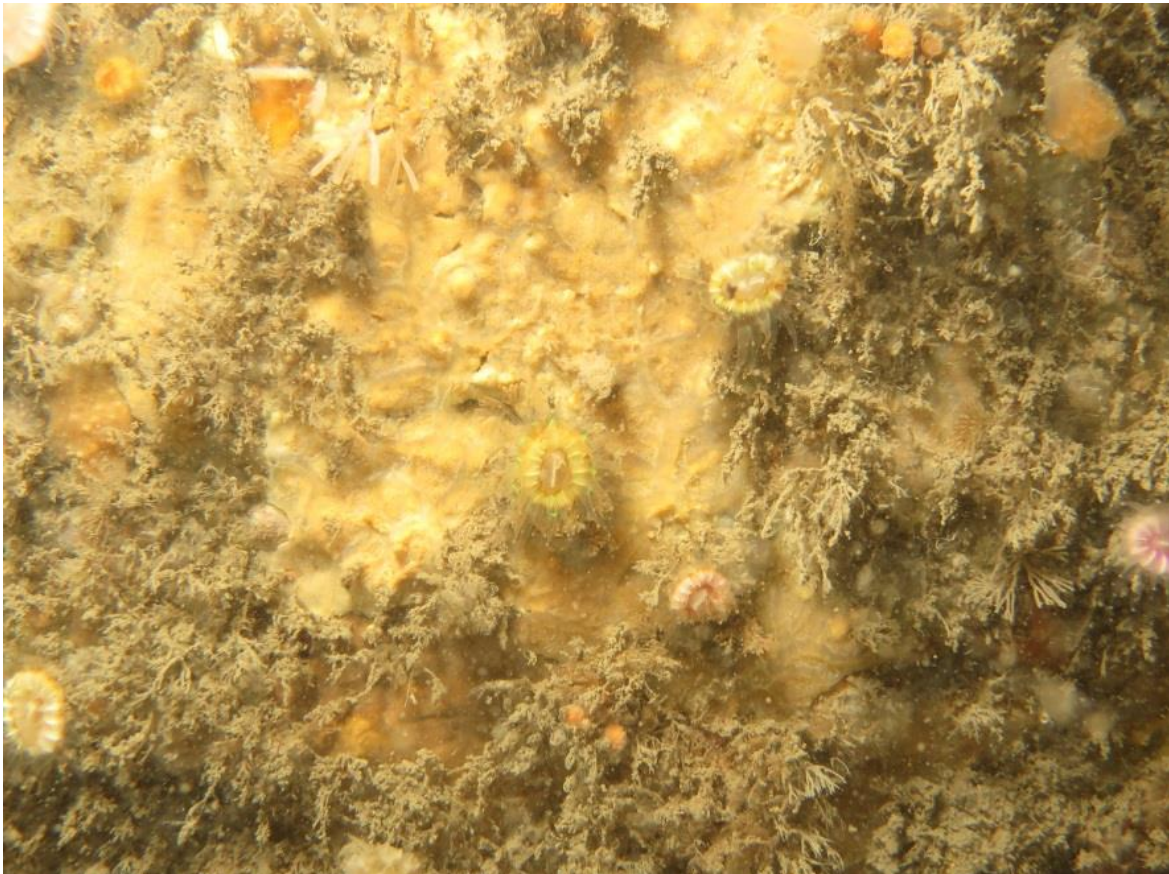


Fig 5.4 *Phorbas* sp.

5.5 *Sphaerotylus* spp.

Two new species of *Sphaerotylus* were first seen and identified in the Skomer MNR in 2007 at Spongy Hillocks, Dog Leg and Windy Gully at the Thorn Rock monitoring area (Bunker & Jones, 2008). There are presently no described species of the genus from the British Isles, and the first records of *Sphaerotylus* spp here were from Southern and Northern Ireland (Picton & Morrow, 2006). It is now being seen throughout the UK.



Fig. 5.5 *Sphaerotylus* sp.

5.6 *Hexadella Topsenti* Reveillaud et al, 2012

This species was previously known as *Hexadella racovitzai*. However, recent molecular research on specimens collected from the Mediterranean and Atlantic has resulted in the genus being split, with two new species being described (Reveillaud et al, 2012). It was first recorded as *H. racovitzai* in the British Isles from the Aran Islands, Co. Galway (Morrow & Picton, 1996). The first record of it in Great Britain was from Skomer at Windy Gully in 2007 (Bunker & Jones, 2008) but it now appears to be relatively common in the reserve, and is being seen with increasing frequency in north Pembrokeshire and the south of England.



Fig. 5.6 *Hexadella topsenti*

5.7 *Eurypon* spp

Several undescribed species of *Eurypon* are known to exist and have been recorded from various locations around the British Isles. At least six undescribed species of the genus have been identified from Skomer during the four-yearly full species surveys alongside the relatively common *Eurypon major*. Research on the group is currently being carried out by Bernard Picton, Ulster Museum.



Fig. 5.7 *Eurypon* sp.

6. Conclusion

Skomer MCZ is one of the richest areas in the UK for sponge biodiversity and with each survey additional species new to science are being discovered, with two more being found during this survey. Four species present in the Reserve are on the nationally scarce species list and several have only recently been described or have limited distribution in the British Isles

Sponges are not easy to identify in-situ and therefore have been poorly recorded in the past. However in recent years records have been increasing and many new species have been discovered and described, and species that have been rarely recorded previously are now being observed more frequently. This could be due in part to the fact that the group has not been extensively studied until now, but it is also evident that some species such as *Hexadella topsenti* and *Sphaerotylus* spp are becoming more widespread and occurring more frequently since first being recorded in the UK. The SMCZ monitoring programme is the only one of its kind in the UK, and it is proving to be a valuable means of gathering long term data on shallow water sponges and their shift in distribution and change in abundance.

The Barcoding Project will provide a comprehensive survey of the biodiversity of the Skomer MCZ sponge community. Significantly, it will also be the most comprehensive genetic analysis of UK Marine sponges to date. The sequences will be added to the Sponge Biodiversity Barcoding project and GenBank, and therefore provide indispensable tools for the identification of sponge species worldwide. Clarification of sponge identification will greatly aid taxonomists, ecologists, and will enhance the discovery of drug-producing species in the long-term.

7. Recommendations

The four-yearly full species monitoring surveys should continue as valuable information is being obtained about the changes in distribution of sponges, particularly in relation to species which appear to be moving geographically and occurring with increasing frequency.

Species of sponge new to science or new to Skomer MCZ are being found each time a survey is undertaken and there are known to be thousands of species worldwide yet to be described. It is important to continue with the monitoring programme to ensure that the species list is constantly being updated.

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